HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P.O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 200311582-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Alan R. Arthur et al.

Confirmation No.: 7536

Application No.: 10/686,896

Examiner: CHUO, Tony Sheng Hsiang

Filing Date: October 15, 2003

Group Art Unit: 1795

Title: Multi-Cell Fuel Cell Layer and System

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Transmitted herewith is the Appeal Brief in this application with respect to the Notice of Appeal filed on February 28, 2008.

☒ The fee for filing this Appeal Brief is $510.00 (37 CFR 41.20).

☐ No Additional Fee Required.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

☐ (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d)) for the total number of months checked below:

☐ 1st Month $120	☐ 2nd Month $460	☐ 3rd Month $1050	☐ 4th Month $1640

☐ The extension fee has already been filed in this application.

☒ (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account 08-2025 the sum of $ 510. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Acoount 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees.

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Typed Name: Rebecca R. Schow
Signature:

Respectfully submitted,
Alan R. Arthur et al.
By
Steven L. Nichols
Attorney/Agent for Applicant(s)
Reg No. : 40,326
Date : April 23, 2008
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Rev 10/07(AplBrief)

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DUPLICATE

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1. Transmittal of Appeal Brief with Duplicate Copy (2 pages)
2. Certificate of Transmission (1 page)
3. Appeal Brief (32 pages)

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In the Patent Application of

Alan R. Arthur et al.

Application No. 10/686,896

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APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This is an Appeal Brief under Rule 41.37 appealing the decision of the Primary Examiner dated December 31, 2007 (the "final Office Action" or "Action"). Each of the topics required by Rule 41.37 is presented herewith and is labeled appropriately.

04/24/2008 PCHOMP 00000039 082025 10686896
01 FC:1402 510.00 DA

I. Real Party in Interest

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 20555 S.H. 249 Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

II. Related Appeals and Interferences

There are no appeals or interferences related to the present application of which the Appellant is aware.

III. Status of Claims

Claims 39-60 have been withdrawn under the imposition of a previous Restriction Requirement and are not at issue. Claims 1-38 and 61-65 are pending in this appeal.

Claims 8 and 25-28 have been indicated as containing allowable subject matter, but are objected to as depending from a rejected base claim. Therefore, claims 8 and 25-28 are involved in the present appeal.

Claims 1-7, 9-24, 29-38 and 61-65 have been finally rejected. Accordingly, Appellant appeals from the rejection of claims 1-7, 9-24, 29-38 and 61-65, which claims are presented in the Appendix.

IV. Status of Amendments

No amendments have been filed subsequent to the final Office Action of December 31, 2007, from which Appellant takes this appeal.

V. Summary of Claimed Subject Matter

During the past several years, the popularity and viability of fuel cells for producing both large and small amounts of electricity has increased significantly. Fuel cells conduct an electrochemical reaction with reactants such as hydrogen and oxygen to produce electricity and heat. A typical fuel cell includes an electrolyte disposed between two electrodes: an anode and a cathode. (Appellant's specification, paragraph 0001).

Appellant's specification describes a fuel cell layer that includes a substrate; an array of fuel cells each having an anode, a cathode, and an electrolyte, disposed on the substrate; conductors electrically coupled to the fuel cell array; a fuel flow channel defined in an anode side of the substrate, and a cathode air flow channel defined in a cathode side of the substrate. (Appellant's specification, paragraph 0016).

Fig. 1A illustrates the cathode side (115), in which a cathode air flow channel (125) is defined in the substrate (110). The cathode air flow channel (125) is a depression, trench, channel or the like formed in the substrate (110) and which runs between, and is in fluid communication with, a cathode air inlet (130) and an excess cathode air outlet (135). The width of the channel (125) accommodates the array of fuel cells (105). As shown in Fig. 1A, the cathode air inlet (130) and excess cathode air outlet (135) are located in opposing corners of the substrate (110). The cathode air flow channel (125) includes an air flow axis (140). During operation, the cathode air flows through the cathode air flow channel (125) in a direction that is generally parallel to the air flow axis (140). The cathode air flows from the cathode air inlet (130) through the cathode air flow channel (125) and out the excess cathode air outlet (135) while also flowing across the individual fuel cells (105). (Appellant's specification, paragraph 0019).

To enhance fuel or air flow over the fuel cell layer (100), flow modification features, such as an array of baffles (185), may be placed in the fuel and/or air streams. Such flow modification features may provide improved fuel cell layer performance by increasing the turbulence of the fuel and air streams, or adjusting the spatial distribution of the flow in the plane of either the air or fuel flows. These modification features (185) can be designed to achieve uniform flow fields across both sides of the fuel cell layer (100). (Appellant's specification, paragraph 0023).

Turning to specific claims, claim 1 recites:

A multi-cell fuel cell layer (*Appellant's specification, paragraph 0016*), comprising:

a substrate (110);

an array of fuel cells (145) each having an anode, a cathode, and an electrolyte disposed on said substrate (110);

conductors (150, 155) electrically coupled to said fuel cell array (145);

a fuel flow channel (160) defined in a first, anode side (120) of said substrate (110); and

a cathode air flow channel (125) defined in a second and opposite, cathode side (115) of said substrate (110) (*Appellant's specification, paragraph 0019*).

Independent claim 16 similarly recites:

A fuel cell system, comprising:

a plurality of fuel cell layers (*Appellant's specification, paragraph 0016*) each including an array of fuel cells (145) each having an anode, a cathode, an electrolyte and conductors disposed on a substrate (110), a fuel flow channel (160) defined in an anode

side (120) of said substrate (110), and a cathode air flow channel (125) defined in an opposite, cathode side (115) of said substrate (110),

wherein said fuel cell layers are alternatingly stacked (*Appellant's specification, paragraph 0028*).

Independent claim 61 recites

An electrochemical system (*Appellant's specification, paragraph 0016*), comprising:

means (110) for supporting an array of fuel cells (145) comprising a substrate;

means (125) defined in a first side (115) of said substrate (110) for conveying cathode air across fuel cells of said array (145); and

means (160) defined in a second, opposite side (120) of said substrate (110) for conveying fuel across said fuel cells of said array (145) (*Appellant's specification, paragraph 0019*).

VI. Grounds of Rejection to be Reviewed on Appeal

In the final Office Action of December 31, 2007, the following grounds of rejection were raised.

(1) Claims 1-5, 7, 11-14, 61 and 62 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent Application Publication No. 2002/0076598 to Bostaph et al. ("Bostaph").

(2) Claim 6 was rejected under 35 U.S.C. § 103(a) over the combined teachings of Bostaph and U.S. Patent No. 5,773,160 to Wilkinson et al. ("Wilkinson").

(3) Claims 9, 10 and 65 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Bostaph and JP 08-213043 to Takayanagi ("Takayanagi").

(4) Claim 15 was rejected under 35 U.S.C. § 103(a) over the teachings of Bostaph taken alone.

(5) Claims 16, 32-34, 36, 63 and 64 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Bostaph and U.S. Patent App. Pub. No. 2003/0022051 to Haluzak ("Haluzak").

(6) Claims 17-24 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Bostaph, Haluzak and Takayanagi.

(7) Claim 29 was rejected under 35 U.S.C. § 103(a) over the combined teachings of Bostaph, Haluzak and U.S. Patent No. 6,503,651 to Nguyen ("Nguyen").

(8) Claims 30 and 31 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Bostaph, Haluzak and Takayanagi.

(9) Claim 35 was rejected under 35 U.S.C. § 103(a) over the teachings of Bostaph, Haluzak and U.S. Patent Application Pub. No. 20030235745 to Mook et al. ("Mook").

(10) Claims 37 and 38 were rejected under 35 U.S.C. § 103(a) over the combined teachings of Bostaph, Haluzak, Takayanagi and Nguyen.

Accordingly, Appellant requests review of these grounds of rejection in the current appeal.

VII. Argument

(1) Claims 1-5, 7, 11-14, 61 and 62 are clearly patentable over Bostaph:

Claims 1 and 61:

Claim 1 recites:

A multi-cell fuel cell layer, comprising:
a substrate;
an array of fuel cells each having an anode, a cathode, and an electrolyte disposed on said substrate;
conductors electrically coupled to said fuel cell array;
a fuel flow channel defined in a first, anode side of said substrate; and
a cathode air flow channel defined in a second and opposite, cathode side of said substrate.
(Emphasis added).

Independent claim 61 recites

An electrochemical system, comprising:
means for supporting an array of fuel cells comprising a substrate;
means defined in a first side of said substrate for conveying cathode air across fuel cells of said array; and
means defined in a second, opposite side of said substrate for conveying fuel across said fuel cells of said array.
(Emphasis added).

Appellant notes that both independent claims 1 and 61 recite "*a* substrate." (Emphasis added). This substrate is recited in the singular, and all subsequent references and recitations are to that "said" single substrate. In particular, claims 1 and 61 recite a first side of the "said" substrate and a second "opposite" side of "said" substrate. One of skill in the art would clearly understand that such language refers to *a* single, two-sided substrate with the two, first and second, sides being *opposite* each other. This is only the reasonable interpretation and plain meaning of Appellant's claims. With this understanding, claims 1 and 61 then further recite a fuel flow channel (or means) and an air flow channel (or means) that are defined in the opposite sides, first and second sides, of the substrate.

In contrast, Bostaph does not teach or suggest the claimed fuel cell layer or system in which a fuel flow channel is defined in one side of a substrate and a cathode air flow channel is defined in a second, opposite side of the same substrate. According to the final Office Action, Bostaph teaches "a fuel flow channel '30' defined in first anode side of the substrate; and a cathode air flow channel '29' defined in a second opposite cathode side of the substrate." (Action, pp. 2-3). This is clearly incorrect.

Fig. 1 of Bostaph is reproduced below.

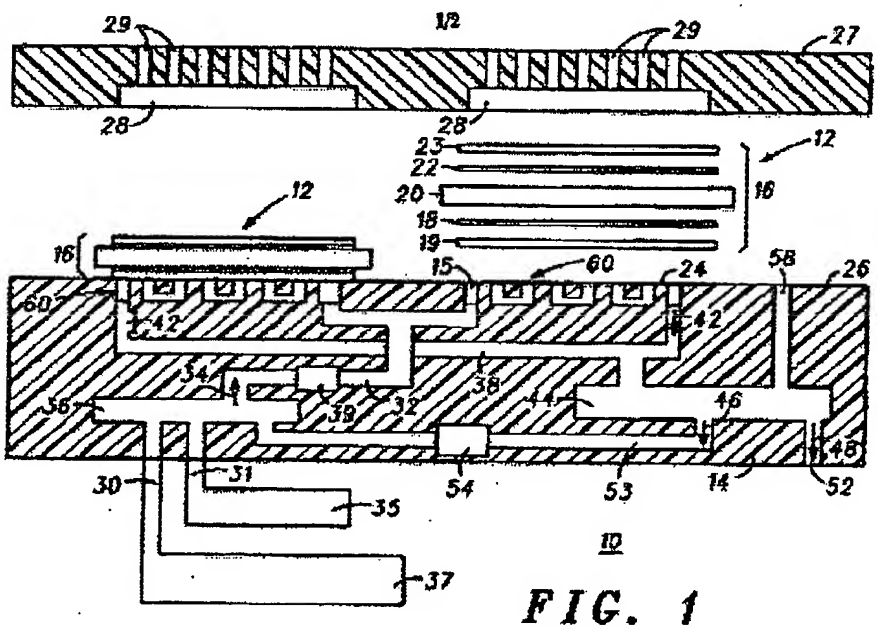

FIG. 1

As can be plainly seen in Fig. 1 of Bostaph, the fuel flow channel identified in the Office Action, element "30," extends into a lower substrate "26." (Action, p. 2). The cathode air flow channel identified in the Office Action, element "29," comprises a number of channels that extend all the way through a second, upper substrate "27." (Action, p. 2). Thus, elements 30 and 29 are located in different and separate substrates.

More specifically, Bostaph teaches "a plurality of fuel cell assemblies 12." (Bostaph, paragraph 0018). The fuel cell assemblies are sandwiched between two substrates. (Bostaph, Fig. 1). One of the substrates, "[b]ase portion 14[,] has formed within a plurality of micro-fluidic channels as illustrated" including a fluid supply channel 32. (Bostaph, paragraph 0019). "Fluid supply channel 32 supplies a fuel-bearing fluid 34 to fuel cell 12." (*Id.*). Then, in the other substrate (27), "a plurality of air flow-throughs 29 [are] positioned to overlay membrane electrode assembly 16." (Bostaph, paragraph 0024).

Consequently, Bostaph clearly does not teach or suggest the claimed subject matter. Specifically, using claim 1 as an example, Bostaph does not teach or suggest "*a* substrate" with "a fuel flow channel defined in a first, anode side of *said* substrate; and a cathode air flow channel defined in a second and opposite, cathode side of *said* substrate." There is no substrate taught or suggested by Bostaph that includes a fuel flow channel defined in one side and a cathode air flow channel in the other. There is no substrate taught by Bostaph that has both an anode side and a cathode side.

In this regard, the final Office Action argues that "[t]here are no limitations in the claims that require a single, one-piece substrate. Therefore, the Bostaph reference still reads on the claims because the substrate can comprise a base portion and a cap portion." (Action, p. 12). Appellant respectfully disagrees. It is well established that the Office is to give claim terms their broadest *reasonable* interpretation during examination. However, the position taken by the final Office Action in this case goes beyond what is reasonable. As noted above, claims 1 and 61 recite "a" singular substrate and specific structure on the first and second *opposite* sides of that "said" substrate. One of skill in the art would clearly understand this to refer to "a" single, two-side substrate with the recited structure being located on the two "opposite" sides. The language is clear.

To the contrary, the interpretation of the claim attempted by the Office Action is unreasonable, disregards what would be understood by one of ordinary skill in the art, and is made for the sole purpose of trying to twist the teachings of Bostaph, using hindsight, to include subject matter that was never taught, suggested or contemplated by the Bostaph reference.

As explained in Appellant's specification, this novel subject matter of claims 1 and 61 allows for more efficient stacking of fuel cells. Accordingly, cell layers can be "alternatingly stacked such that a fuel cell layer shares a fuel flow channel with a first adjacent fuel cell layer on one side and a cathode air flow channel with a second adjacent fuel cell layer on the other side." (Appellant's specification, paragraph 0028). These advantages were unknown and unavailable in the cited prior art, particularly Bostaph. As demonstrated above, Bostaph requires two separate substrates for a single fuel cell layer whereas Appellant's invention reduces the number of substrates required in a stack.

In sum, Bostaph clearly fails to teach or suggest the subject matter of claims 1 and 61, specifically, a fuel flow channel or means defined in a first side of substrate with a cathode air flow channel or means defined in the second, opposite side of that substrate. A claim is anticipated [under 35 U.S.C. § 102] only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. of California*, 2 U.S.P.Q.2d 1051, 1053 (Fed. Cir. 1987) (emphasis added). See M.P.E.P. § 2131. Therefore, for at least the reasons discussed here, the rejection of all the pending claims should not be sustained.

Claim 4:

Claim 4 further recites "a cathode air inlet and an excess cathode air outlet defined in said substrate." According to the final Office Action, Bostaph "discloses a cathode air inlet '29' and an excess cathode air outlet '28' that are defined in the substrate." (Action, p. 3). However, element "28" of Bostaph is not an excess cathode air outlet, but rather is a "current collector." (Bostaph, paragraph 0027). It is entirely unclear why the Office Action seeks to characterize this current collector as the claimed excess cathode air outlet.

Consequently, Bostaph clearly fails to teach or suggest all the subject matter of claim 4. Additionally, claims 5 and 6 depend from claim 4 and recite additional subject matter that is not taught or suggested by Bostaph. "To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974)." M.P.E.P. § 2143.03. Accord. M.P.E.P. § 706.02(j). Therefore, the rejection of claims 4-6 should not be sustained.

Claim 12:

Claim 12 recites "wherein said electrolyte seals non-active portions of said substrate." In this regard, the Office Action argues that Bostaph "discloses an electrolyte "20" that seals non-active portions of the substrate (See Figure 1)." (Action, p. 4). However, it is unclear from Fig. 1 if the electrolyte (20) even makes contact with either substrate, let alone seal non-active portions of the substrate. Consequently, the Action fails to make out a *prima facie* case of unpatentability with regard to claim 12, and the rejection of claim 12 should not be sustained.

Claim 13:

Claim 13 recites "flow modification features associated with either or both of said fuel flow channel and said cathode air flow channel, said flow modification features being configured to distribute a flow of fuel or air emerging from an inlet across a width of said fuel flow channel or said air flow channel, respectively." In this regard, the Office Action cites to Bostaph's Fig. 2. However, according to Bostaph, Fig. 2 illustrates "a plurality of ceramic layers, generally referenced 62, 64, and 66, having formed therein a plurality of three-dimensional microfluidic fuel deliver channels." (Bostaph, paragraph 0029). This, however, is not a teaching or suggestion of the claimed flow modification features "being configured to distribute a flow of fuel or air emerging *from an inlet across a width of said fuel flow channel or said air flow channel*, respectively." (Emphasis added). For at least this additional reason, the rejection of claims 13 and 14 should not be sustained.

(2) Claim 6 is patentable over Bostaph and Wilkinson:

This rejection should not be sustained for at least the same reasons given above with respect to the patentability of claim 1.

(3) Claims 9, 10 and 65 are patentable over Bostaph and Takayangi:

Claims 9, 10, 30-32 and 65 are patentable over Bostaph and Takayangi for at least the reasons given herein with respect to their corresponding independent claims.

(4) Claim 15 is patentable over Bostaph:

Claim 15 is patentable over Bostaph for at least the same reasons given herein with respect to the patentability of the corresponding independent claim.

(5) Claims 16, 32-34, 36, 63 and 64 are patentable over Bostaph and Haluzak:

Claim 16:

Independent claim 16 recites:

> A fuel cell system, comprising:
> a plurality of fuel cell layers each including an array of fuel cells each having an anode, a cathode, an electrolyte and conductors disposed on a substrate, *a fuel flow channel defined in an anode side of said substrate, and a cathode air flow channel defined in an opposite cathode side of said substrate*,
> wherein said fuel cell layers are alternatingly stacked.

(Emphasis added).

In contrast, as demonstrated above, Bostaph does not appear to teach or suggest a fuel cell system in which a plurality of fuel cell layers are disposed on a substrate with "a fuel flow channel defined in an anode side of said substrate, and a cathode air flow channel defined in an opposite cathode side of said substrate." Moreover, as Applicant has previously explained on the record, Haluzak also fails to teach or suggest this subject matter.

As shown in Figs. 4 and 5, each layer of the Haluzak system includes a substrate (62) which may be, for example, a silicon wafer. (Haluzak, paragraph 0025). Fuel cells, including the anode (50), electrolyte (42) and cathode (48), are formed on the substrate (62). (Haluzak, paragraph 0023). Fuel chambers (52) are formed or defined in, and extend through, the substrate (62). (Haluzak, paragraph 0025). ***However, there is no cathode air flow channel that is similarly defined in an opposite or cathode side of the substrate.***

To the contrary, as clearly shown in Figs. 4-6, the fuel cells (50, 42, 48) are formed on one side of the substrates (62). The substrates are then stacked and placed in a frame (80) so as to allow air chambers (54) to exist *between the substrates*. However, there is no cathode air flow channel *defined in an opposite, cathode side of the substrate* as claimed. Thus, neither of the cited prior art references teaches or suggests the claimed "a fuel flow channel

defined in an anode side of said substrate, and a cathode air flow channel defined in an opposite cathode side of said substrate, "

Additionally, as noted above, Appellant has disclosed that given "a fuel flow channel defined in an anode side of said substrate, and a cathode air flow channel defined in an opposite cathode side of said substrate," the fuel cell layers can be alternatingly stacked to reduce the number of substrates used. Specifically, cell layers can be "alternatingly stacked such that a fuel cell layer shares a fuel flow channel with a first adjacent fuel cell layer on one side and a cathode air flow channel with a second adjacent fuel cell layer on the other side." (Appellant's specification, paragraph 0028). Such advantage is entirely lost and cannot be achieved with the double substrate structure taught by Bostaph. The final Office Action does not address this difference between the subject matter of claim 16 and the cited prior art.

Under the analysis required by *Graham v. John Deere*, 383 U.S. 1 (1966) to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in view of the ordinary skill in the art. In the present case, the scope and content of the prior art, as evidenced by Bostaph and Haluzak, did not include the claimed fuel cell system in which a plurality of fuel cell layers are disposed on a substrate with "a fuel flow channel defined in an anode side of said substrate, and a cathode air flow channel defined in an opposite cathode side of said substrate." Rather, this subject matter appears to be wholly outside the scope of the cited prior art.

This difference between the cited prior art and the claimed subject matter is significant because the cited prior art did not provide the benefits available in the claimed subject matter, such as a reduced number of substrates in a stack and improved sealing and thermal cycle stress reduction. (*See* Applicant's specification, paragraph 0030). For at least these reasons,

the combination of Bostaph and Haluzak will not support a rejection of claim 16 under 35 U.S.C. § 103(a) and *Graham*. Therefore, the rejection of claim 16 should not be sustained.

(6) Claims 17-24 are patentable over Haluzak and Takayanki:

Claims 17-24 are patentable over Haluzak and Takayanki for at least the same reasons given herein with respect to the patentability of the corresponding independent claim.

(7) Claims 22-24 are patentable over Haluzak, Takayanki and Wilkinson:

Claims 17-21 are patentable over Haluzak, Takayanki and Wilkinson for at least the same reasons given herein with respect to the patentability of the corresponding independent claim.

(8) Claim 29 is patentable over Haluzak and Nguyen:

This rejection is respectfully traversed for at least the same reasons given above with respect to the patentability of the corresponding independent claim.

Additionally, claim 29 recites "wherein said fuel flow channels or air flow channels comprise ports that can be opened or closed to selectively activate or deactivate each individual layer of said plurality of layers." The Office has previously conceded that Haluzak does not teach this subject matter. (Action of 8/30/06, p. 7). Consequently, the Action cites to Nguyen in this regard. (Action, p. 13).

Nguyen teaches a method "for operating such a fuel cell system includes supplying fuel to the fuel inlets from a common source of fuel and supplying an oxidant to the oxidant inlets from a common source of oxidant. The outlets of a given cell are selectively opened to purge fuel product and oxidant product from the given cell while the outlets of other cells are

kept closed." (Nguyen, abstract). Thus, Nguyen does not teach or suggest the claimed ports that selectively activate or deactivate individual fuel cell layers. Rather, Nguyen merely teaches that, *while all cells are operating*, they can be individually purged of byproducts.

The final Office Action acknowledges this shortcoming of Nguyen, but seeks to willfully overlook it. According to the Action, "[a]lthough Nguyen does teach valves that are individually operated to purge the byproducts from each fuel cell layer, the Nguyen reference is relied upon for teaching the concept of using valves to selectively open or close ports in the flow channels of each individual layer." (Action, p. 13). This, however, is not the full extent of what is claimed.

Claim 29 does not merely recite "the concept of using valves to selectively open or close ports in the flow channels of each individual layer." (Action, p. 13). Rather, claim 29 recites "wherein said fuel flow channels or air flow channels comprise ports that can be opened or closed *to selectively activate or deactivate each individual layer of said plurality of layers*." (Emphasis added). This subject matter is outside the teachings of the cited prior art.

Under the analysis required by *Graham v. John Deere*, 383 U.S. 1 (1966) to support a rejection under § 103, the scope and content of the prior art must first be determined, followed by an assessment of the differences between the prior art and the claim at issue in view of the ordinary skill in the art. In the present case, the scope and content of the prior art, as evidenced by Bostaph, Haluzak and Nguyen, did not include the claimed "fuel flow channels or air flow channels [that] comprise ports that can be opened or closed to selectively activate or deactivate each individual layer of said plurality of layers."

For at least these reasons, the cited prior art will not support a rejection of claim 29 under 35 U.S.C. § 103(a) and *Graham*. Therefore, the rejection of claim 29 should be reconsidered and withdrawn.

(9) Claim 35 is patentable over Haluzak and Mook:

Claim 35 is patentable over Haluzak and Mook for at least the same reasons given herein with respect to the patentability of the corresponding independent claim.

(10) Claims 37 and 38 are patentable over Haluzak, Takayanki, Wilkinson and Nguyen:

Claims 37 and 38 are patentable over Haluzak, Takayanki, Wilkinson and Nguyen for at least the same reasons given herein with respect to the patentability of the corresponding independent claim.

In view of the foregoing, it is submitted that the final rejection of the pending claims is improper and should not be sustained. Therefore, a reversal of the final rejection of December 31, 2007 is respectfully requested.

Respectfully submitted,

DATE: April 23, 2008

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VIII. CLAIMS APPENDIX

1. (previously presented) A multi-cell fuel cell layer, comprising:

a substrate;

an array of fuel cells each having an anode, a cathode, and an electrolyte disposed on said substrate;

conductors electrically coupled to said fuel cell array;

a fuel flow channel defined in a first, anode side of said substrate; and

a cathode air flow channel defined in a second and opposite, cathode side of said substrate.

2. (original) The fuel cell layer of claim 1, further comprising a fuel inlet and an exhaust defined in said substrate.

3. (original) The fuel cell layer of claim 2, wherein said fuel inlet and said exhaust are in fluid communication with said fuel flow channel.

4. (original) The fuel cell layer of claim 2, further comprising a cathode air inlet and an excess cathode air outlet defined in said substrate.

5. (original) The fuel cell layer of claim 4, wherein said cathode air inlet and said excess cathode air outlet are in fluid communication with said cathode air flow channel.

6. (previously presented) The fuel cell layer of claim 4, wherein said fuel inlet and exhaust are defined in first and second opposing corner portions of said substrate and said

inlet cathode air and excess cathode air outlets are defined in third and fourth opposing corner portions of said substrate.

7. (previously presented) The fuel cell layer of claim 1, wherein said array of fuel cells are disposed within said fuel flow channel and said cathode air flow channel.

8. (previously presented) The fuel cell layer of claim 4, wherein said conductors comprise a positive conductor extending to said cathode air inlet and a negative conductor extending to said excess cathode air outlet.

9. (original) The fuel cell layer of claim 1, wherein said fuel flow channel is defined along a first axis and said cathode air flow channel is disposed along a second axis disposed at an angle with said first axis.

10. (original) The fuel cell layer of claim 9, wherein said first axis is substantially normal to said second axis.

11. (original) The fuel cell layer of claim 1, wherein said conductors are located on said cathode side of said substrate, said cathode side serving as a circuit side of said substrate.

12. (original) The fuel cell layer of claim 1, wherein said electrolyte seals non-active portions of said substrate.

13. (previously presented) The fuel cell layer of claim 1, further comprising flow modification features associated with either or both of said fuel flow channel and said cathode air flow channel, said flow modification features being configured to distribute a flow of fuel or air emerging from an inlet across a width of said fuel flow channel or said air flow channel, respectively.

14. (original) The fuel cell layer of claim 13, wherein said flow modification features comprise a plurality of baffles.

15. (original) The fuel cell layer of claim 1, wherein said conductors are located on said anode side of said substrate, said anode side serving as a circuit side of said fuel cell layer.

16. (previously presented) A fuel cell system, comprising:

a plurality of fuel cell layers each including an array of fuel cells each having an anode, a cathode, an electrolyte and conductors disposed on a substrate, a fuel flow channel defined in an anode side of said substrate, and a cathode air flow channel defined in an opposite, cathode side of said substrate,

wherein said fuel cell layers are alternating stacked.

17. (previously presented) The system of claim 16, wherein said fuel cell layers are coupled such that a fuel cell layer shares a fuel flow channel with a first adjacent fuel cell layer thereby forming a fuel flow plenum.

18. (original) The system of claim 17, wherein said fuel cell layers are coupled such that a fuel cell layer shares a cathode air flow channel with a second adjacent fuel cell layer thereby forming a cathode air flow plenum.

19. (original) The system of claim 18, further comprising fuel inlets and exhausts defined in said substrates.

20. (original) The system of claim 19, wherein a plurality of said fuel inlets form a fuel inlet plenum and a plurality of said exhausts form an exhaust plenum.

21. (original) The system of claim 20, wherein said fuel inlet plenum and said exhaust plenum are in fluid communication with said fuel flow plenums.

22. (original) The system of claim 21, further comprising cathode air inlets and excess cathode air outlets defined in said substrates.

23. (original) The system of claim 22, wherein a plurality of said cathode air inlets form a cathode air inlet plenum and a plurality of said excess cathode air outlets form an excess cathode air outlet plenum.

24. (original) The system of claim 23, wherein said inlet cathode air plenum and said excess cathode air outlet plenum are in fluid communication with said cathode air flow plenums.

25. (previously presented) The system of claim 24, wherein said conductors further comprise a positive conductor on each of said fuel cell layers extending to said cathode air inlets and a negative conductor on each of said fuel cell layers extending to said excess cathode air outlets.

26. (previously presented) The system of claim 25, further comprising a positive stack connection coupled to each of said positive conductors through said inlet cathode air plenum and a negative stack connection coupled to each of said negative conductors through said excess cathode air outlet plenum.

27. (previously presented) The system of claim 26, wherein fuel inlets and exhausts are defined in first and second opposing corner portions of said substrates and said inlet cathode air inlets and excess cathode air outlets are defined in third and fourth opposing corner portions of said substrates.

28. (previously presented) The system of claim 27, wherein said inlets comprise ports that can be opened or closed to selectively activate or deactivate each individual layer of said plurality of layers.

29. (previously presented) The system of claim 16, wherein said fuel flow channels or air flow channels comprise ports that can be opened or closed to selectively activate or deactivate each individual layer of said plurality of layers.

30. (previously presented) The system of claim 16, wherein each of said fuel flow channels is defined along a first axis and each of said cathode air flow channels is defined along a second axis disposed at an angle with said first axis.

31. (original) The system of claim 30, wherein said first axis is substantially normal to said second axis.

32. (previously presented) The system of claim 16, wherein each of said cathode sides comprises a circuit side, wherein said conductors are located on said circuit side.

33. (original) The system of claim 16, wherein said electrolyte seals non-active portions of said substrate.

34. (original) The system of claim 16, further comprising:

a fuel inlet and an exhaust fluidly coupled to each said fuel flow channel;

a cathode air inlet and an excess cathode air outlet fluidly coupled to each said cathode air flow channel; and

seals disposed around said inlets, exhaust and outlet and around a perimeter of said fuel cell array.

35. (original) The system of claim 34, wherein said seals comprise an electrically conductive material.

36. (original) The system of claim 16, wherein said fuel cell layers are coupled so as to form a parallel electrical circuit.

37. (previously presented) The system of claim 24, further comprising a fuel manifold having a plurality of selectively opened inlet ports coupled to said fuel flow plenums disposed within said fuel inlet plenum, and an exhaust manifold having a plurality of selectively opened inlet ports coupled to said fuel flow plenums disposed within said exhaust plenum.

38. (original) The system of claim 37, further comprising a cathode air inlet manifold having a plurality of selectively opened inlet ports coupled to said cathode air flow plenums disposed within said cathode air inlet plenum, and an excess cathode air manifold having a plurality of selectively opened inlet ports coupled to said cathode air flow plenums disposed within said excess cathode air plenum.

39-60. (cancelled)

61. (previously presented) An electrochemical system, comprising:

means for supporting an array of fuel cells comprising a substrate;

means defined in a first side of said substrate for conveying cathode air across fuel cells of said array; and

means defined in a second, opposite side of said substrate for conveying fuel across said fuel cells of said array.

62. (original) The system of claim 61, further comprising means for removing electricity from said array of fuel cells.

63. (original) The system of claim 62, further comprising a plurality of said supporting means.

64. (original) The system of claim 63, wherein said plurality of supporting means comprises means for delivering and removing fuel and cathode air to and from said system.

65. (original) The system of claim 61, wherein said cathode air and said fuel flow in directions substantially normal to each other across cathodes and anodes of said fuel cells respectively.

IX. Evidence Appendix

None

X. Related Proceedings Appendix

None

XI. Certificate of Service

None